Received: 22 July 2021 | Accepted: 14 September 2021

DOI: 10.1002/pri.1923

RESEARCH ARTICLE

WILEY

Dizziness and physical health are associated with pain in dizzy patients—A cross-sectional study

Ingvild Ølfarnes Gustavsen[1] | Kjersti Wilhelmsen[1] | Adam P. Goode[1,2,3] | Stein Helge Glad Nordahl[4,5] | Frederik Kragerud Goplen[4,5] | Roy Miodini Nilsen[1] | Liv Heide Magnussen[1]

[1]Department of Health and Functioning, Faculty of Health and Social Sciences, Western Norway University of Applied Sciences, Bergen, Norway

[2]Department of Orthopaedic Surgery, Duke University School of Medicine, Durham, North Carolina, USA

[3]Duke Clinical Research Institute, Duke University School of Medicine, Durham, North Carolina, USA

[4]Norwegian National Advisory Unit on Vestibular Disorders, Department of Otorhinolaryngology & Head Neck Surgery, Haukeland University Hospital, Bergen, Norway

[5]Department of Clinical Medicine, University of Bergen, Bergen, Norway

Correspondence
Kjersti Wilhelmsen, Department of Health and Functioning, Faculty of Health and Social Sciences, Western Norway University of Applied Sciences, Norway.
Email: kwi@hvl.no

Abstract

Background and Purpose: Associations between dizziness, health-related quality of life, and musculoskeletal pain have not been systematically explored in patients with vestibular disorders. Such knowledge may be important for choice of treatments. The study objectives were to examine the extent and localization of musculoskeletal pain and explore whether pain was associated with dizziness and health-related quality of life.

Methods: The cross-sectional study investigated anonymized data from an earlier survey on patients with long-lasting dizziness (>3 months) examined in an oto-rhino-laryngological department. The sample includes patient between 18 and 70 years with Ménière's disease, vestibular schwannoma, benign positional paroxysmal vertigo, vestibular neuritis, non-otogenic dizziness, and cervicogenic dizziness. General musculoskeletal, that is, pain in muscles, tendons, and joints was registered by a yes/no question. A pain drawing registered localization of pain. Multiple binary logistic regression models were used to determine the association between pain and vertigo-balance and autonomic-anxiety related dizziness by the short Vertigo Symptom Scale (VSS) and sub-scales (VSS-V, VSS-A), and between pain and health-related quality of life by the SF-36, mental and physical component summary scale (SF-36 MCS, SF-36 PCS).

Results: The sample consisted of 503 patients, 60.2% were women, the median age was 50 years. General musculoskeletal pain was reported by 72.8% of patients, neck pain by 59.2% and widespread pain by 21.9%. Multiple binary logistic regression models demonstrated that all the pain measures were significantly associated with VSS-V and VSS-A and SF-36 PCS, but not SF-36 MCS.

Discussions: Musculoskeletal pain is prevalent in patients with long-lasting dizziness. The strong associations between pain, VSS, and SF-36 PCS could result in a self-sustaining complex condition. The findings imply that in addition to assessing

Ingvild Ølfarnes Gustavsen and Kjersti Wilhelmsen are first authors.

and treating the vestibular symptoms, musculoskeletal symptoms and physical health should be addressed.

KEYWORDS
dizziness, musculoskeletal pain, quality of life, vertigo

1 | INTRODUCTION

Dizziness, which is common in the general and patient populations, can be associated with several conditions. Peripheral vestibular disorders are examples of conditions which typically are associated with vertigo, that is, dizziness described as a false sensation of spinning or rocking (Bisdorff et al., 2015). The prognosis following acute vestibular disorders, in for example vestibular neuritis, is usually favorable. In most cases symptoms resolve within weeks. If symptoms persist and are present for 3 months or more, the condition is defined as chronic (Hall et al., 2016), leaving some with a risk of disability pension (Skøien et al., 2008), others with a risk of developing persistent postural-perceptual dizziness (PPPD) (Staab et al., 2017).

Our clinical experience, supported by research (Kvåle et al., 2008; Malmstrom et al., 2019; Wilhelmsen & Kvale, 2014), indicates that musculoskeletal aberrations and pain co-exist with dizziness when dizziness persists. To the extent that issues of pain have been addressed, focus has been on neck pain (Iglebekk et al., 2013; Kalland Knapstad et al., 2020; Malmström et al., 2007). Whether pain in general also is associated with dizziness, have to our knowledge not been systematically explored.

Pain, a common symptom in musculoskeletal disorders, impacts an individual's health-related quality of life and function (Picavet & Hoeymans, 2004). Disabilities and reduced health have also been reported in patients with dizziness (Kalland Knapstad et al., 2020; Ten Voorde et al., 2012; Weidt et al., 2014) influencing everyday life.

As far as we are aware, knowledge is sparse regarding the associations between pain, dizziness symptoms and health-related quality of life in patients with long-lasting dizziness. The aim of the present study was to examine the extent and localization of musculoskeletal pain, and to explore whether dizziness and health-related quality of life were associated with pain. Our hypothesis was that pain would be associated with both.

2 | METHODS

2.1 | Design and setting

Patients examined for dizziness in an oto-rhino-laryngological department between 1992 and 2001 participated in a postal survey in 2002. The survey included 821 patients. Of these, 503 patients responded to the invitation, that is, a response rate of 61%. The study was approved by the Regional Committee for Medical Research Ethics in Western Norway (REK West 143.98) and the Norwegian Centre for Research Data (NSD): 8766/2005008708. The study was carried out according to the Helsinki declarations and all the participants returned informed consents. Details, including information related to the different diagnostic groups, can be found in Wilhelmsen and colleagues' study (Wilhelmsen et al., 2009).

Data were anonymized according to guidelines given by NSD prior to analyses in the current study: Information on chronological age was altered to age categories, other potential identifiable variables (i.e., occupation, social status) were removed. The scrambling key had already been deleted. As it is not possible to connect information to an individual person, further ethical approval was not required.

Data were anonymized according to guidelines given by NSD prior to analyses in the current study: Information on chronological age was altered to age categories, other potential identifiable variables (i.e., occupation, social status) were removed. The scrambling key had already been deleted. As it is not possible to connect information to an individual person, further ethical approval was not required. The current study is part of ongoing research in our department looking into chronic dizziness as a complex condition.

2.2 | Subjects

Participants were eligible for the study if they were between 18 and 70 years having any of the following diagnoses: Ménière's disease, vestibular schwannoma, benign positional paroxysmal vertigo (BPPV), vestibular neuritis, non-otogenic dizziness, and cervicogenic dizziness. Central vestibular disorders (stroke, MS, traumatic brain injuries) were set as an exclusion criterion.

2.3 | Data collection

2.3.1 | Background information

Background information consisted of sex, age, education, and diagnoses. Duration of dizziness at the time of survey was calculated based on reports of debut of symptoms.

2.3.2 | Outcome variables

General musculoskeletal pain was registered by the following yes/no question: “Are you bothered with pain in muscle, tendon and/or joints?” and termed “general musculoskeletal pain.” Patients were also asked to mark perceived pain during the last 14 days on a pain-

drawing (Kvåle et al., 2001; Skouen et al., 1997). A horizontal division line in the mid-thoracic region (back and front), indicated upper and lower body-halves. Sub-grouping was done according to the participants' indication of pain localization. Markings above the line in the neck-shoulder area on the backside of the figure, was termed "neck pain." Markings above and below the line on the back *and* front of the figure, was termed "widespread pain." Responses were registered as yes/no, respectively.

2.3.3 | Exposure variables

Current dizziness was identified by a yes/no question. Frequency and severity of dizziness last month was examined by the short version of the Vertigo Symptom Scale (VSS) (Yardley, Donovan-Hall, et al., 2004; Yardley et al., 1992). The response categories consist of a five-point Likert type of scale (0–4), higher score indicate more frequent and severe problems. The scale can be used as a total summary scale (VSS: 15 items, score-range: 0–60 points, severe dizziness ≥ 12 points) (Yardley, Donovan-Hall, et al., 2004). The translated Norwegian version has satisfactory validity and reliability (ICCs: 0.88–0.90) (Wilhelmsen et al., 2008). Two sub-scales are identified: (1) vertigo-balance related dizziness (VSS-V: eight items, score-range 0–32 points, cut-off ≤ 2.5) and (2) autonomic-anxiety related dizziness (VSS-A: seven items, score-range 0–28 points, cut off ≤ 3.5) (Wilhelmsen et al., 2008).

Physical and mental health were derived from the SF-36 instrument (Ware et al., 1994). SF-36 (version 1.2) is translated to Norwegian and has satisfactory validity and reliability (Garratt & Stavem, 2017; Loge et al., 1998). The instrument consists of eight sub-scales with Cronbach's alpha exceeding 0.80 for all scales (Garratt & Stavem, 2017). The sub-scales can be merged into two summary scales: (1) Physical health component summary scale (SF-36 PCS) and (2) Mental health component summary scale (SF-36 MCS). The score ranges from 0 to 100, with higher score indicating good self-reported physical and mental health related quality of life.

2.4 | Statistical analyses

All data analyses were carried out using SPSS Version 24.0 for Windows. To describe the sample, we used descriptive statistics by means and standard deviations (SDs) for continuous variables and count and proportions for categorical variables. The one-way analysis of variance (ANOVA) was used to test differences in means between multiple groups, and student's *t*-test between two groups. To examine the association of neck pain, widespread pain, and general musculoskeletal pain as three separate outcomes (dependent factors) with dizziness and health-related quality of life as exposures (independent factors), we used binary logistic regression models. Analyses were performed crude and with adjustment for sex, age and education as these variables are commonly associated with health status (Fillingim et al., 2009; Ross & Wu, 1995). Age was divided into age categories: 18–29, 30–39, 40–49, 50–59, 60–71 years. Education was categorized as: ≤10, 11–13, ≥14 years. Associations were presented as odds ratios with 95% confidence intervals (CIs).

3 | RESULTS/FINDINGS

Overall, general musculoskeletal pain was reported by 72.8%, neck pain by 59.2%, and widespread pain by 21.9% of the patients. The majority (60.2%) were women. Around 50% were older than 50 years, the distribution was 18–29 years: 5.2%; 30–39 years: 15.5%; 40–49 years: 23.9%; 50–59 years: 31%; and 60–71 years: 24.5%. With respect to education ≤10 years was reported by 21.7%; 11–13 years: 42.9%; and ≥14 years: 26.2%.

The largest diagnostic group was non-otogenic dizziness (25.8%), followed by BPPV (17.9%), vestibular neuritis (17.7%), Ménière's disease (18.3%), cervicogenic dizziness (12.3%) and vestibular schwannoma (8%). Dizziness was confirmed by 73% of the patients at the time of the survey, and of these 80% reported dizzy spells the last month. Symptom duration ranged from 8 months to 53 years. Severe dizziness (VSS ≥ 12 points) was seen in the total group, the mean score of VSS was 13.9 (SD: 10.8). The scores on the dizziness subscales were VSS-V: 7.5 (SD: 6.8) and VSS-A: 6.4 (SD: 5.3) respectively. The mean SF-36 PCS score was 42.3 (SD: 11), and for the SF-36 MCS the score was 48 (SD: 11). Details regarding demographic information in view of the three pain measures are presented in Table 1.

Women reported lower VSS-V (VSS-V $p = 0.041$) and SF-36 PCS ($p = 0.006$) compared to men (Table 2). There was no difference between men and women regarding VSS-A and SF-36 MCS scores. SF-36 PCS declined with increasing age ($p = 0.001$). VSS-V and VSS-A scores improved with longer education ($p = 0.05$ and 0.001 respectively), as did SF-36 PCS and SF-36 MCS scores ($p = 0.000$ and 0.023 respectively). Patients in the non-otogenic group reported more severe scores on VSS-V and VSS-A compared to the other groups (Table 2). SF-36 PCS and SF-36 MCS scores varied little across diagnoses (Table 2).

All the pain outcome measures were significantly associated with VSS-V, VSS-A, and SF36-PCS, both in the unadjusted and adjusted regression analyses (Table 3). For each unit increase in the VSS-V and VSS-A scores and decrease in SF-36 PCS score, there was an increased likelihood for having musculoskeletal pain. SF-36 MCS was not associated with any of the pain measures.

4 | DISCUSSION

The results in this study indicate that musculoskeletal pain is common in patients with persistent dizziness, and that pain is associated with increasingly worse dizziness and reduced physical health. Our hypotheses that an association would exist between pain and dizziness, and pain and physical health were supported, irrespective of pain

TABLE 1 Prevalence of musculoskeletal pain types by patient characteristics

	Neck pain, *n* = 503		Widespread pain, *n* = 396[a]		General musculoskeletal pain, *n* = 496[a]	
Characteristics	**Yes, *n* (%)**	**No, *n* (%)**	**Yes, *n* (%)**	**No, *n* (%)**	**Yes, *n* (%)**	**No, *n* (%)**
Gender, *n* (%)						
Female	196 (64.7)	107 (35.3)	79 (31.9)	169 (68.1)	236 (79.2)	62 (20.8)
Male	102 (51.0)	98 (49.0)	31 (21.0)	117 (79.0)	130 (65.7)	68 (34.3)
Age, *n* (%)						
0–29	14 (53.9)	12 (46.1)	3 (18.8)	13 (81.2)	13 (50.0)	13 (50.0)
30–39	49 (62.8)	29 (37.2)	13 (20.6)	50 (79.4)	51 (67.1)	25 (32.9)
40–49	72 (60.0)	48 (40.0)	26 (26.3)	73 (73.7)	91 (75.8)	29 (24.2)
50–59	98 (62.8)	58 (37.2)	40 (32.3)	84 (67.7)	118 (76.6)	36 (23.4)
≥60	65 (52.9)	58 (47.1)	28 (29.8)	66 (70.2)	93 (77.5)	27 (22.5)
Education, *n* (%)						
≤10 years	69 (63.3)	40 (36.7)	21 (23.6)	68 (76.4)	86 (78.9)	23 (21.1)
11–13 years	139 (64.4)	77 (35.6)	59 (31.6)	128 (68.4)	164 (77.7)	47 (22.3)
≥14 years	66 (50.0)	66 (50.0)	18 (20.9)	68 (79.1)	82 (62.1)	50 (37.9)
Diagnosis, *n* (%)						
Ménière's disease	48 (52.2)	44 (47.8)	13 (21.3)	48 (78.7)	65 (73.0)	24 (27.0)
Vestibular schwannoma	19 (47.5)	21 (52.5)	13 (48.2)	14 (51.8)	24 (60.0)	16 (40.0)
BPPV	55 (61.1)	35 (38.9)	21 (28.4)	53 (71.6)	74 (84.1)	14 (15.9)
Vestibular neuritis	45 (50.6)	44 (49.4)	16 (23.5)	52 (76.5)	58 (65.9)	30 (34.1)
Non-otogenic dizziness	84 (64.6)	46 (35.4)	31 (29.0)	76 (71.0)	90 (69.8)	39 (30.2)
Cervicogenic dizziness	47 (75.8)	15 (24.2)	16 (27.1)	43 (72.9)	55 (88.7)	7 (11.3)
Months between debut of dizziness to survey, mean (SD)	99.2 (74.7)	111.8 (85.1)	103.7 (62.7)	101.4 (80.9)	100.6 (74.8)	113.0 (88.1)
VSS-V, mean (SD)	9.0 (6.9)	5.4 (6.1)	9.9 (7.3)	7.8 (6.7)	8.4 (7.0)	5.4 (5.9)
VSS-A, mean (SD)	7.6 (5.2)	4.6 (4.9)	9.4 (5.7)	6.2 (4.7)	7.0 (5.2)	4.8 (5.2)
SF-36 PCS, mean (SD)	39.3 (9.7)	46.6 (11.3)	36.1 (9.0)	41.3 (10.1)	39.5 (10.2)	50.0 (9.7)
SF-36 MCS, mean (SD)	47.3 (11.3)	48.9 (10.7)	45.2 (11.1)	48.5 (11.4)	47.6 (11.5)	49.2 (9.7)

Abbreviations: BPPV, benign paroxysmal positional vertigo; SD, standard deviation.; SF-36 MCS, SF-36 mental component summary scale; SF-36 PCS, SF-36 physical component summary scale; VSS-A, autonomic-anxiety related dizziness; VSS-V, vertigo-balance related dizziness.

[a]Widespread pain: 107 (21.3%) missing; general musculoskeletal pain: 7 (1.4%) missing.

being measured as a general, widespread, or local phenomenon. Our results did not however, support the assumption of an association between mental health and musculoskeletal pain. In addition, neither gender, age, nor education had any influence on the associations.

The majority, 73% of our patients, experienced musculoskeletal pain in at least one location. However, only 22% marked pain in all four body divisions (upper/lower/front/back). The pain drawing allows the measurement of localized pain across multiple body locations and therefore enables categorization into local and widespread pain. The categorization with markings on back *and* front of the figure, could have contributed to reducing the numbers regarding widespread pain as some participants may not have completed the entire diagram. Widespread pain is commonly identified through markings above and below the midline, either on the front *or* the back of the drawing (Kvåle et al., 2001; Skouen et al., 1997). For many patients with dizziness neck pain seems to be essential, and this is also seen in our study as 59% indicated neck pain.

In the Norwegian population, reports of general musculoskeletal pain ranges 8%–23% (Hagen et al., 2006; Kinge et al., 2015) while the one-week prevalence of neck pain is 34% (Natvig et al., 2010). The finding regarding general pain was high in our study. It was higher than that in the Norwegian population and higher than that reported by others on patients with dizziness. In the latter group reports on general pain vary between 40% and 58% (Iglebekk et al., 2013; Iglebekk et al., 2015; Malmstrom et al., 2019). In a study on patients with uncompensated vestibular

TABLE 2 Mean scores of dizziness (VSS) and health-related quality of life (SF-36) by patient characteristics

Characteristics	Study participants *n*	VSS-V Mean (SD)	VSS-A Mean (SD)	SF-36 PCS Mean (SD)	SF-36 MCS Mean (SD)
Gender					
Female	303	8.0 (6.9)	6.6 (5.3)	41.2 (11.3)	48.2 (11.1)
Male	200	6.8 (6.6)	6.0 (5.3)	44.0 (10.4)	47.7 (11.1)
p-Value[a]	-	0.041	0.204	0.006	0.609
Age					
0–29	26	7.7 (4.7)	7.9 (5.4)	44.3 (11.2)	47.0 (9.8)
30–39	78	7.8 (6.7)	6.0 (4.9)	45.9 (10.8)	49.5 (10.6)
40–49	120	7.9 (6.6)	6.3 (5.0)	42.8 (11.1)	46.6 (10.6)
50–59	156	6.8 (6.9)	6.8 (5.4)	41.9 (10.6)	48.1 (10.9)
≥60	123	7.6 (6.8)	5.9 (5.7)	39.3 (10.6)	48.3 (12.3)
p-Value[a]	-	0.770	0.313	0.001	0.468
Education					
≤10 years	109	8.2 (7.1)	7.4 (5.2)	37.7 (10.0)	47.1 (11.3)
11–13 years	216	7.6 (6.5)	6.6 (5.1)	42.3 (10.7)	47.1 (11.4)
≥14 years	132	6.2 (6.0)	5.0 (4.7)	46.7 (10.4)	50.2 (9.0)
p-Value[a]	-	0.050	0.001	0.000	0.023
Diagnosis					
Ménière's disease	92	6.9 (6.4)	6.0 (5.3)	43.6 (11.4)	47.9 (10.5)
Vestibular schwannoma	40	4.4 (4.7)	4.3 (4.1)	41.8 (10.1)	48.1 (9.8)
BPPV	90	7.9 (7.3)	5.9 (5.5)	40.9 (10.7)	48.7 (12.1)
Vestibular neuritis	89	7.2 (7.0)	6.3 (5.3)	44.0 (10.4)	48.0 (11.1)
Non-otogenic dizziness	130	8.2 (7.0)	7.5 (5.5)	41.8 (11.5)	47.1 (11.4)
Cervicogenic dizziness	62	7.9 (6.6)	6.9 (4.9)	41.1 (11.2)	48.7 (10.4)
p-Value[a]	-	0.013	0.013	0.360	0.926

Abbreviations: BPPV, benign paroxysmal positional vertigo; SD, standard deviation; SF-36 MCS, SF-36 mental component summary scale; SF-36 PCS, SF-36 physical component summary scale; VSS, Vertigo Symptom Scale; VSS-A, autonomic-anxiety related dizziness; VSS-V, vertigo-balance related dizziness.

[a]By ANOVA or *t*-test.

disorder, 29% had widespread pain according to the pain drawing (Kvåle et al., 2008), comparable to the finding in the present study. The distribution and localization of pain, within eight available bodyparts in the study by Malmstrøm et al. (2019) ranged from 10% in the torso to 60% in the neck/shoulder area (Malmstrom et al., 2019). The latter is comparable to our results; 59% of our patients had neck pain. Others have reported the prevalence of neck pain to vary between 33% and 92% (Bjorne et al., 1998; Iglebekk et al., 2013, 2015; Kalland Knapstad et al., 2020; Kvåle et al., 2008; Malmstrom et al., 2019). Direct comparison between studies is difficult. The concepts used to describe general, widespread, and local pain varies, and data collection instruments and methods differ. In addition, most of the studies are small, and demographic information is inconsistent. Our study is based on a large group of patients (n = 503) with persistent dizziness, and symptoms of pain and dizziness seem to co-exist. Studies addressing the extent, localization and intensity of pain in more detail are needed.

Strong associations were seen between pain and dizziness. Associations were identified with respect to vertigo-balance and autonomic-anxiety related dizziness which probably can be connected to sensations of unsteadiness. Pain has an impact on balance (Lihavainen et al., 2010; Ruhe et al., 2011a, 2011b; Yahia et al., 2009), and unsteadiness may increase a feeling of insecurity in everyday life situations. This could lead to anxiety and emotional stress (Malmstrom et al., 2019; Weidt et al., 2014) especially during ambulation, resulting in perceptions of disability (Vereeck et al., 2007). Pain was also strongly associated with reduced physical health among our patients. Pain, independent of dizziness, is common in musculoskeletal conditions and associated with reduced physical health

TABLE 3 Association between dizziness, physical, and mental health and musculoskeletal pain types

Risk scores	Crude OR[a] (95% CI)	Adjusted OR[a] (95% CI)[b]
Neck pain		
VSS-V	1.09 (1.06–1.13)	1.10 (1.06–1.14)
VSS-A	1.13 (1.09–1.18)	1.14 (1.08–1.19)
SF-36 PCS	0.94 (0.92–0.95)	0.93 (0.91–0.95)
SF-36 MCS	0.99 (0.97–1.00)	0.99 (0.97–1.01)
Widespread pain		
VSS-V	1.05 (1.01–1.08)	1.05 (1.01–1.08)
VSS-A	1.12 (1.08–1.17)	1.14 (1.08–1.20)
SF-36 PCS	0.95 (0.93–0.97)	0.95 (0.92–0.97)
SF-36 MCS	0.98 (0.96–1.00)	0.98 (0.96–1.00)
General musculoskeletal pain		
VSS-V	1.08 (1.04–1.12)	1.07 (1.03–1.12)
VSS-A	1.09 (1.05–1.14)	1.08 (1.03–1.14)
SF-36 PCS	0.90 (0.88–0.92)	0.90 (0.88–0.93)
SF-36 MCS	0.99 (0.97–1.01)	0.99 (0.97–1.01)

Abbreviations: CI, confidence interval; OR, odds ratio; SF-36 MCS, SF-36 mental component summary scale; SF-36 PCS, SF-36 physical component summary scale; VSS-A, autonomic-anxiety related dizziness; VSS-V, vertigo-balance related dizziness.

[a]OR estimated for one unit increase in VSS-V and VSS-V, and one unit decrease in SF-36 PCS and SF-36 MCS.

[b]Adjusted for age, gender, and education.

(Picavet & Hoeymans, 2004). Dizziness alone has however, also a negative impact on physical health (Weidt et al., 2014). The co-existence of pain and dizziness could reinforce each other (Kvåle et al., 2001; Ten Voorde et al., 2012; van der Windt et al., 2008) and impact physical health, including cardiovascular health (Herdman & Whitney, 2014).

It seems reasonable to assume that pain and dizziness co-exist in patients with persistent dizziness and become intertwined with physical health influencing everyday life. It is possible that the concurrent symptoms are part of a sensitization process that may reinforce a decline in physical health. The threshold for experiencing symptoms is lowered leading to increased perception of symptom severity and/or intensity when the condition persists. Hypervigilance to perceived threats, that is, dizziness and pain, lead to restrictions in movements, as well as provoking other muscular reactions (Vlaeyen & Linton, 2000; Yardley, Jahanshahi, & Hallam, 2004). To the extent that pain has been addressed in patients with dizziness, focus has been on neck pain (Kalland Knapstad et al., 2020; Knapstad et al., 2020; Malmstrom et al., 2019) which has been suggested as a driving force (Iglebekk et al., 2013) and an amplifier for dizziness severity (Kalland Knapstad et al., 2020). The neck is central in upholding postural stability and therefore important. "What comes first" can be challenging to identify, but a combination of neck pain and dizziness could disturb the integration of vestibular and neck proprioceptive afferents in the brainstem and cerebellum, and lead to impairments in postural and perceptual reflexes (Treleaven, 2008; Yahia et al., 2009) resulting in unsteadiness. The process gives rise to a self-reinforcing multidirectional circle exacerbating dizziness and pain and influence physical health. Over time it could lead to the development of a more complex condition as for example PPPD (Staab et al., 2017) which is associated with anxiety and hypervigilance, increasing bodily tension related to fear of falling (Goplen, 2020). According to Norwegian Psychomotor Physiotherapy the body is an integrated unit without clear divisions between emotional, psychological, and physical reactions (Thornquist & Bunkan, 1991). Local aberrations in the vestibular and musculoskeletal system, may over time influence the whole body and result in compensatory strategies (Thornquist & Bunkan, 1991; Wilhelmsen & Kvale, 2014) which in turn could contribute towards upholding the complaints.

A significant association was also seen between pain and anxiety related dizziness. The lack of association between pain and mental health was therefore somewhat surprising. The two instruments are related to the perception of health, but the underlying concepts differ. The SF-36 is a generic measure, the questions on mental health are more general and related to how emotions impact daily life functioning. In Norwegian the understanding of «health» is more closely associated with physical aspects of the concept (Loge et al., 1998). The questions on mental health might not quite match the perception of the responders as opposed to the VSS which addresses more specifically anxiety as it relates do dizziness. These questions might therefore be more relevant.

The sample is representative for patients with chronic dizziness seen both in specialist (Obermann et al., 2015) and primary care (Garrigues et al., 2008; Yardley et al., 1998). Women are over-represented, most of the patients are in their fifties, and dizziness has lasted over time.

5 | IMPLICATIONS ON PHYSIOTHERAPY PRACTICE

The efficacy of traditional vestibular rehabilitation (VR) has been demonstrated (Hall et al., 2016; McDonnell & Hillier, 2015), but VR alone is not always sufficient (Krebs et al., 2003). The co-existence of dizziness with other disorders indicate a complex condition requiring multimodal approaches (Malmstrom et al., 2019). The current study explores pain as a potential contributor to upholding dizziness. A "locked head" and stiff body posture leading to muscular tension was described by M. Dix already in the 1970s (Dix, 1976). According to Dix, these symptoms also needed to be addressed to avoid "chronic invalidism and helplessness." It might be useful to revisit this line of thought in today's physiotherapy practice for dizzy patients. Systematic assessment and treatment of musculoskeletal pain and aberrations could be beneficial in enhancing everyday function, but seem to be overlooked in clinical practice (Malmstrom et al., 2019). Studies combining traditional measures of VR with body awareness therapies and cognitive approaches are in progress in our research group (Kristiansen, Magnussen, Juul-Kristensen, et al., 2019; Kristiansen, Magnussen, Wilhelmsen, et al., 2019). Physiotherapists also need to be aware of the importance of improving physical health as patients with dizziness often become deconditioned (Herdman & Whitney, 2014). Physical activity protects against musculoskeletal ailments as well as improving cardiovascular health. Enhancing physical fitness could be beneficial for the individual in a direct manner, but also indirectly by giving the individual more physical and mental energy to handle the consequences of dizziness in everyday life.

To our knowledge, this is the largest study that systematically explores musculoskeletal pain and the associations between pain and health-related quality of life in patients with long-lasting dizziness. All the associations are explicit, and the same trends were seen irrespective of the way pain was measured which strengthens the findings. It is possible that musculoskeletal pain and dizziness reciprocally sustain and influence each other impacting physical health, giving rise to a complex condition. It is therefore important to aware that such associations may develop and address it in assessment and treatment when dizziness persists. Studies that explore pain and factors related to pain from different perspectives, are needed.

ACKNOWLEDGMENTS

We would like to thank the patients who participated in the original study and thereby facilitating the present study. We would also like to thank the Norwegian Fund for Postgraduate Training in Physiotherapy supporting the original study.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ETHICS STATEMENT

The original study was approved by the Regional Committee for Medical Research Ethics in Western Norway (REK West 143.98) and the Norwegian Centre for Research Data: 8766/2005008708. The study was carried out according to the Helsinki declarations and all the participants returned informed consents. The current study used anonymized data.

AUTHOR CONTRIBUTIONS

Ingvild Ølfarnes Gustavsen and Liv Heide Magnussen designed the study, performed statistical analysis, and drafted manuscript. Kjersti Wilhelmsen collected data in the original study, participated in designing the current study, contributed to analysis of data and drafting the manuscript. Adam P. Goode participated in designing the study, contributed to analysis of data and drafting the manuscript. Frederik Kragerud Goplen and Stein Helge Glad Nordahl participated in designing the original study and collecting the data. Roy Miodini Nilsen participated in analyses of data. All authors have read and approved the final manuscript.

DATA AVAILABILITY STATEMENT

The dataset is available on request from Professor Liv Heide Magnussen, Western Norway University of Applied Sciences at Liv.Heide.Magnussen@hvl.no.

ORCID

Ingvild Ølfarnes Gustavsen https://orcid.org/0000-0001-7558-9540
Kjersti Wilhelmsen https://orcid.org/0000-0002-6345-1031
Adam P. Goode https://orcid.org/0000-0002-0793-3298
Stein Helge Glad Nordahl https://orcid.org/0000-0003-1543-7603
Frederik Kragerud Goplen https://orcid.org/0000-0002-8022-9483
Roy Miodini Nilsen https://orcid.org/0000-0002-6340-4593
Liv Heide Magnussen https://orcid.org/0000-0001-8119-7922

REFERENCES

Bisdorff, A. R., Staab, J. P., & Newman-Toker, D. E. (2015). Overview of the international classification of vestibular disorders. *Neurologic Clinics*, *33*(3), 541–550, vii. https://doi.org/10.1016/j.ncl.2015.04.010

Bjorne, A., Berven, A., & Agerberg, G. (1998). Cervical signs and symptoms in patients with Meniere's disease: A controlled study. *Cranio*, *16*(3), 194–202. https://doi.org/10.1080/08869634.1998.11746057

Dix, M. R. (1976). The physiological basis and practical value of head exercises in the treatment of vertigo. *Practitioner*, *217*(1302), 919–924.

Fillingim, R. B., King, C. D., Ribeiro-Dasilva, M. C., Rahim-Williams, B., & Riley, J. L., 3rd. (2009). Sex, gender, and pain: A review of recent clinical and experimental findings. *The Journal of Pain*, *10*(5), 447–485. https://doi.org/10.1016/j.jpain.2008.12.001

Garratt, A. M., & Stavem, K. (2017). Measurement properties and normative data for the Norwegian SF-36: Results from a general population survey. *Health and Quality of Life Outcomes*, *15*(1), 51. https://doi.org/10.1186/s12955-017-0625-9

Garrigues, H. P., Andres, C., Arbaizar, A., Cerdan, C., Meneu, V., Oltra, J. A., Santonja, J., & Pérez, A. (2008). Epidemiological aspects of vertigo in the general population of the Autonomic Region of Valencia, Spain. *Acta Oto-Laryngologica*, *128*(1), 43–47. https://doi.org/10.1080/00016480701387090

Goplen, F. (2020). Perifere og sentrale vestibulære sykdommer. In K. Wilhelmsen, A.-L. Tamber, & A. K. Skøien (Eds.), *Fra svimmelhet til balanse* (1st ed., pp. 111–128). Fagbokforlaget.

Hagen, K., Svebak, S., & Zwart, J. A. (2006). Incidence of musculoskeletal complaints in a large adult Norwegian county population. The HUNT Study. *Spine (Phila Pa 1976)*, *31*(18), 2146–2150. https://doi.org/10.1097/01.brs.0000231734.56161.6b

Hall, C. D., Herdman, S. J., Whitney, S. L., Cass, S. P., Clendaniel, R. A., Fife, T. D., Furman, J. M., Getchius, T. S. D., Goebel, J. A., Shepard, N. T., & Woodhouse, S. N. (2016). Vestibular rehabilitation for peripheral vestibular hypofunction: An evidence-based clinical practice guideline: From the American Physical Therapy Association Neurology Section. *Journal of Neurologic Physical Therapy*, *40*(2), 124–155. https://doi.org/10.1097/NPT.0000000000000120

Herdman, S. J., & Whitney, S. L. (2014). Physical therapy treatment of vestibular hypofunction. In S. J. Herdman & R. A. Clendaniel (Eds.), *Vestibular rehabilitation* (pp. 394–431). F.A. Davies.

Iglebekk, W., Tjell, C., & Borenstein, P. (2013). Pain and other symptoms in patients with chronic benign paroxysmal positional vertigo (BPPV). *Scandinavain Journal of Pain*, *4*, 233–240. https://doi.org/10.1016/j.sjpain.2013.06005

Iglebekk, W., Tjell, C., & Borenstein, P. (2015). Treatment of chronic canalithiasis can be beneficial for patients with vertigo/dizziness and chronic musculoskeletal pain, including whiplash related pain. *Scandinavain Journal of Pain*, *8*, 1–7. https://doi.org/10.1016/j.sjpain.2015.02.002

Kalland Knapstad, M., Goplen, F., Skouen, J. S., Ask, T., & Nordahl, S. H. G. (2020). Symptom severity and quality of life in patients with concurrent neck pain and dizziness. *Disability & Rehabilitation*, *42*(19), 2743–2746. https://doi.org/10.1080/09638288.2019.1571640

Kinge, J. M., Knudsen, A. K., Skirbekk, V., & Vollset, S. E. (2015). Musculoskeletal disorders in Norway: Prevalence of chronicity and use of primary and specialist health care services. *BMC Musculoskeletal Disorders*. *16*, 75. https://doi.org/10.1186/s12891-015-0536-zkv

Knapstad, M. K., Nordahl, S. H. G., Skouen, J. S., Ask, T., & Goplen, F. K. (2020). Neck pain associated with clinical symptoms in dizzy patients—A cross-sectional study. *Physiotherapy Research International*, *25*(2), e1815. https://doi.org/10.1002/pri.1815

Krebs, D. E., Gill-Body, K. M., Parker, S. W., Ramirez, J. V., & Wernick-Robinson, M. (2003). Vestibular rehabilitation: Useful but not universally so. *Otolaryngology–Head and Neck Surgery*, *128*(2), 240–250. https://doi.org/10.1067/mhn.2003.72

Kristiansen, L., Magnussen, L. H., Juul-Kristensen, B., Maeland, S., Nordahl, S. H. G., Hovland, A., Sjøbø, T., & Wilhelmsen, K. T. (2019). Feasibility of integrating vestibular rehabilitation and cognitive behaviour therapy for people with persistent dizziness. *Pilot and Feasibility Studies*, *5*, 69. https://doi.org/10.1186/s40814-019-0452-3

Kristiansen, L., Magnussen, L. H., Wilhelmsen, K. T., Maeland, S., Nordahl, S. H. G., Clendaniel, R., Hovland, A., & Juul-Kristensen, B. (2019). Efficacy of intergrating vestibular rehabilitation and cognitive behaviour therapy in persons with persistent dizziness in primary care—A study protocol for a randomised controlled trial. *Trials*, *20*(1), 575. https://doi.org/10.1186/s13063-019-3660-5

Kvåle, A., Ellertsen, B., & Skouen, J. S. (2001). Relationships between physical findings (GPE-78) and psychological profiles (MMPI-2) in patients with long-lasting musculoskeletal pain. *Nordic Journal of Psychiatry*, *55*(3), 177–184. https://doi.org/10.1080/08039480152036056

Kvåle, A., Wilhelmsen, K., & Fiske, H. A. (2008). Physical findings in patients with dizziness undergoing a group exercise programme. *Physiotherapy Research International*, *13*(3), 162–175. https://doi.org/10.1002/pri.402

Lihavainen, K., Sipila, S., Rantanen, T., Sihvonen, S., Sulkava, R., & Hartikainen, S. (2010). Contribution of musculoskeletal pain to postural balance in community-dwelling people aged 75 years and older. *Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences*, *65*(9), 990–996. https://doi.org/10.1093/gerona/glq052

Loge, J. H., Kaasa, S., Hjermstad, M. J., & Kvien, T. K. (1998). Translation and performance of the Norwegian SF-36 Health Survey in patients with rheumatoid arthritis. I. Data quality, scaling assumptions, reliability, and construct validity. *Journal of Clinical Epidemiology*, *51*(11), 1069–1076. https://doi.org/10.1016/S0895-4356(98)00098-5

Malmström, E. M., Karlberg, M., Melander, A., Magnusson, M., & Moritz, U. (2007). Cervicogenic dizziness—Musculoskeletal findings before and after treatment and long-term outcome. *Disability and Rehabilitation*, *29*(15), 1193–1205. https://doi.org/10.1080/09638280600948383

Malmstrom, E. M., Magnusson, M., Holmberg, J., Karlberg, M., & Fransson, P.-A. (2019). Dizziness and localized pain are often concurrent in patients with balance or psychological disorders. *Scandinavain Journal of Pain*, *20*, 353–362. https://doi.org/10.1515/sjpain-2019-0121

McDonnell, M. N., & Hillier, S. L. (2015). Vestibular rehabilitation for unilateral peripheral vestibular dysfunction. *Cochrane Database of Systematic Reviews*, *1*, CD005397. https://doi.org/10.1002/14651858.CD005397.pub4

Natvig, B., Ihlebaek, C., Grotle, M., Brage, S., & Bruusgaard, D. (2010). Neck pain is often a part of widespread pain and is associated with reduced functioning. *Spine (Phila Pa 1976)*, *35*(23), E1285–E1289. https://doi.org/10.1097/BRS.0b013e3181e38e73

Obermann, M., Bock, E., Sabev, N., Lehmann, N., Weber, R., Gerwig, M., Frings, M., Arweiler-Harbeck, D., Lang, S., & Diener, H.-C. (2015). Long-term outcome of vertigo and dizziness associated disorders following treatment in specialized tertiary care: The Dizziness and Vertigo Registry (DiVeR) Study. *Journal of Neurology*, *262*(9), 2083–2091. https://doi.org/10.1007/s00415-015-7803-7

Picavet, H. S., & Hoeymans, N. (2004). Health related quality of life in multiple musculoskeletal diseases: SF-36 and EQ-5D in the DMC3 study. *Annals of the Rheumatic Diseases*, *63*(6), 723–729. https://doi.org/10.1136/ard.2003.010769

Ross, C. E., & Wu, C. L. (1995). The links between education and health. *American Sociological Review*, *60*(5), 719–745. https://doi.org/10.2307/2096319

Ruhe, A., Fejer, R., & Walker, B. (2011a). Altered postural sway in patients suffering from non-specific neck pain and whiplash associated disorder—A systematic review of the literature. *Chiropractic & Manual Therapies*, *19*(1), 13. https://doi.org/10.1186/2045-709X-19-13

Ruhe, A., Fejer, R., & Walker, B. (2011b). Center of pressure excursion as a measure of balance performance in patients with non-specific low back pain compared to healthy controls: A systematic review of the literature. *European Spine Journal*, *20*(3), 358–368. https://doi.org/10.1007/s00586-010-1543-2

Skøien, A. K., Wilhelmsen, K., & Gjesdal, S. (2008). Occupational disability caused by dizziness and vertigo: A register-based prospective study. *British Journal of General Practice*, *58*(554), 619–623. https://doi.org/10.3399/bjgp08X330744

Skouen, J. S., Vilsvik, D., & Ellertsen, B. (1997). A new and simple classification system of chronic low back pain patients. In *Proceedings of the 24th annual meeting of the international society for the study of the lumbar spine* (pp. 108–109).

Staab, J. P., Eckhardt-Henn, A., Horii, A., Jacob, R., Strupp, M., Brandt, T., & Bronstein, A. (2017). Diagnostic criteria for persistent postural-perceptual dizziness (PPPD): Consensus document of the committee for the Classification of Vestibular Disorders of the Barany Society. *Journal of Vestibular Research*, *27*(4), 191–208. https://doi.org/10.3233/VES-170622

Ten Voorde, M., van der Zaag-Loonen, H. J., & van Leeuwen, R. B. (2012). Dizziness impairs health-related quality of life. *Quality of Life Research*, *21*(6), 961–966. https://doi.org/10.1007/s11136-011-0001-x

Thornquist, E., & Bunkan, B. H. (1991). *What is psychomotor therapy?*. Norwegian University Press.

Treleaven, J. (2008). Sensorimotor disturbances in neck disorders affecting postural stability, head and eye movement control. *Manual Therapy*, *13*, 2–11. https://doi.org/10.1016/j.math.2007.06.003

van der Windt, D. A., Dunn, K. M., Spies-Dorgelo, M. N., Mallen, C. D., Blankenstein, A. H., & Stalman, W. A. (2008). Impact of physical symptoms on perceived health in the community. *Journal of Psychosomatic Research*, *64*(3), 265–274. https://doi.org/10.1016/j.jpsychores.2007.10.003

Vereeck, L., Truijen, S., Wuyts, F. L., & Van de Heyning, P. H. (2007). The dizziness handicap inventory and its relationship with functional balance performance. *Otology & Neurotology*, *28*(1), 87–93. https://doi.org/10.1097/01.mao.0000247821.98398.0d

Vlaeyen, J. W., & Linton, S. J. (2000). Fear-avoidance and its consequences in chronic musculoskeletal pain: A state of the art. *Pain*, *85*(3), 317–332. https://doi.org/10.1016/S0304-3959(99)00242-0

Ware, J. E., Kosinski, M., & Keller, S. D. (1994). *SF-36 physical and mental health summary scales: A user's manual*. Health Assessment Lab.

Weidt, S., Bruehl, A. B., Straumann, D., Hegemann, S. C., Krautstrunk, G., & Rufer, M. (2014). Health-related quality of life and emotional distress in patients with dizziness: A cross-sectional approach to disentangle their relationship. *BMC Health Services Research*, *14*, 317. https://doi.org/10.1186/1472-6963-14-317

Wilhelmsen, K., & Kvale, A. (2014). Examination and treatment of patients with unilateral vestibular damage, with focus on the musculoskeletal system: A case series. *Physical Therapy*, *94*(7), 1024–1033. https://doi.org/10.2522/ptj.20130070

Wilhelmsen, K., Ljunggren, A. E., Goplen, F., Eide, G. E., & Nordahl, S. H. (2009). Long-term symptoms in dizzy patients examined in a university clinic. *BMC Ear Nose and Throat Disorders*, *9*(1), 2. https://doi.org/10.1186/1472-6815-9-2

Wilhelmsen, K., Strand, L. I., Nordahl, S. H., Eide, G. E., & Ljunggren, A. E. (2008). Psychometric properties of the Vertigo symptom scale—Short form. *BMC Ear, Nose and Throat Disorders*, *8*, 2. https://doi.org/10.1186/1472-6815-8-2

Yahia, A., Ghroubi, S., Jribi, S., Malla, J., Baklouti, S., Ghorbel, A., & Elleuch, M. H. (2009). Chronic neck pain and vertigo: Is a true balance disorder present? *Annals of Physical and Rehabilitation Medicine*, *52*(7–8), 556–567. https://doi.org/10.1016/j.rehab.2009.07.033

Yardley, L., Donovan-Hall, M., Smith, H. E., Walsh, B. M., Mullee, M., & Bronstein, A. M. (2004). Effectiveness of primary care-based vestibular rehabilitation for chronic dizziness. *Annals of Internal Medicine*, *141*(8), 598–605. https://doi.org/10.7326/0003-4819-141-8-200410190-00007

Yardley, L., Jahanshahi, M., & Hallam, R. S. (2004). Psychosocial aspects of disorders affecting balance and gait. In A. Bronstein, T. Brandt, M. Woollacott, & J. Nutt (Eds.), *Clinical disorders of balance posture and gait* (2nd. ed., pp. 360–384). Arnold.

Yardley, L., Masson, E., Verschuur, C., Haacke, N., & Luxon, L. (1992). Symptoms, anxiety and handicap in dizzy patients: Development of the vertigo symptom scale. *Journal of Psychosomatic Research*, *36*(8), 731–741. http://www.ncbi.nlm.nih.gov/pubmed/1432863

Yardley, L., Owen, N., Nazareth, I., & Luxon, L. (1998). Prevalence and presentation of dizziness in a general practice community sample of working age people. *British Journal of General Practice*, *48*(429), 1131–1135.

How to cite this article: Gustavsen, I. Ø., Wilhelmsen, K., Goode, A. P., Nordahl, S. H. G., Goplen, F. K., Nilsen, R. M., & Magnussen, L. H. (2021). Dizziness and physical health are associated with pain in dizzy patients—A cross-sectional study. *Physiotherapy Research International*, *26*(4), e1923. https://doi.org/10.1002/pri.1923